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Methodological Luddism: A concept for tying degrowth to the assessment and regulation of technologies

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ABSTRACT

This article sets out an alternative approach to the assessment and regulation of technology and innovation, situated in and aiming at degrowth and building on an idea first put forward in the late 1970s by Langdon Winner called "methodological Luddism". Methodological Luddism does not have the original meaning of destroying machines, nor does it reflect a prejudiced attitude or a negative view of technology. As outlined in this article, it sets out to overcome the presumption that technology is value-neutral and to lower the inflated expectations with which it is generally associated. Technology and forms of life are mutually interdependent, and this implies examining the constructive possibilities for withdrawing from some technologies and adopting others, while ensuring that their role is limited to means designed to achieve certain predefined ends. The article draws on the work of Hans Jonas and Albert Borgmann, authors yet to be acknowledged by the degrowth literature. Jonas' principle of responsibility is a response to the excessive prowess of modern technologies, while Borgmann suggests a reform of technology through focal things and practices. Building on these concepts, methodological Luddism advocates reassessing and reorienting technologies so that informed decisions may be taken as to how they should be designed and developed as means to socially equitable and ecologically sustainable ends. In this way the technological sphere may become an important ally in the transformative change in society which is required to fulfil the axiological parameters of degrowth.

1. Introduction

This article sets out an alternative approach to the assessment and regulation of technology and innovation, situated in and aiming at degrowth and building on an idea first advanced by Langdon Winner (1978) called "methodological Luddism". The historical origins of the terms "Luddite" and "Luddism" lie in nineteenth-century Britain, in the revolts of textile workers led supposedly by Ned Ludd in defence of their way of life against the threatening introduction of mechanization, at the same time as liberal reforms were being implemented (Thompson, 1963; Bourdeau et al., 2006; Sale, 2006; Van Daal, 2012). Numerous groups and movements outside mainstream institutions and academia (Chevassus-au-Louis, 2006) have used Luddism since the 1990s, in a context of technological and economic change and global ecological crisis, to express vigorous opposition to technology and to examine it in critical fashion.

As a methodology,[1] Winner's proposal does not advocate destroying machines. Instead, it questions what conventional thought has regarded as technical and economic progress. For Winner, Luddism is a reflexive methodology for reassessing human relationships with current technology and innovation. It looks to new technological forms appropriate to avoiding the human problems of a technology-dominated world moving rapidly in a wrong direction (Winner, 1978: 330).

The proposal put forward here is justified on the grounds that

[1] In this article, methodology is understood as not being connected with the idea of "method", but with the study/analysis of the evaluation of methods and the regulation of technologies, while still being centred on scientific/ontological questions relating to technology. Recovering the example of Luddite dissidence is *methodological* because it meets the primary objective of the social sciences, which is to offer an *understanding* of social phenomena.

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various basic standards and needs of contemporary society are largely involved in and configured by technological networks and systems. The technological factor thus needs to be questioned further, for two main reasons: on the one hand, there are inflated expectations in relation to technology (Grunwald, 2018), allied with the ubiquitous idea of its neutrality (Ihde, 1993; Verbeek, 2011); on the other, there is a lack of understanding of how technological progress encourages operational complexity in processes linked to human life, causing serious problems of social diversity, political differentiation and economic inequality (Rescher, 1999). Today's scientific and technological research institutions are committed to and sustain a set of choices and technological designs largely guided by financial and production criteria. The emergence of risks, and increasing inequalities and uncertainties, are some of the serious consequences of these choices (Beck, 1992 [1986]; Krimsky, 2004; Nowotny et al., 2005). Any steps towards degrowth should therefore bind technologies to an assessment, whether at the point of design or in relation to their later consequences, in the light of a diverse set of values, with the aim of regulating, encouraging, inhibiting or reorganizing technologies in a proper fashion towards ends.

The article is divided into four parts. Part 1 sums up some attitudes towards technology, including the ambivalence and scepticism which encourage discussion on the politicization and axiology of technology. The work of authors yet to be acknowledged by the degrowth literature, like Hans Jonas and Albert Borgmann, taken in conjunction with Winner's key insight, further justifies updating his concept of methodological Luddism. Part 2, drawing on Hans Jonas, outlines how contemporary technology demands a new rationale for action, because it has shifted the assumptions of all previous ethical systems. Jonas establishes the principle of responsibility as a response to the excessive prowess of modern technologies in amplifying their unexpected effects on nature and human life. Part 3 looks at the consequences of realigning technological development from mere means back into appropriate ends, using the methodological Luddism approach to technological development and innovation to argue for further assessment and regulation beyond current domains and areas. Finally, in part 4, two descriptive examples of other possible relationships with technology are presented. In both, actors have creatively disconnected from common technological systems. Borgmann's concept of focal things and practices is used to substantiate methodological Luddism throughout these examples.

2. From technological enthusiasm to methodological Luddism

The degrowth project has incorporated several critiques of the idea of infinite progress, which emphasises material well-being and the twentieth-century consumer society (Nørgård, 2013). Some perspectives on degrowth have also drawn on the philosophy of technology and social studies of science and technology, as part of a reassessment of the assumptions and means of economic growth and the institutions associated with it (Latouche, 2007; D'Alisa and Kallis, 2015; Heikkurinen, 2018). These contributions have highlighted the limits of technological optimism, questioning the neutrality of technology as mere means. Other authors have emphasized the importance of not ignoring the unforeseeable, the risks and the uncertainties which technologies bring to various domains, warning that inflated expectations of technological progress are to be avoided (Ellul, 1988; Beck, 1992 [1986]; Dupuy, 2002; Martins, 2011). In addition, declining material and non-renewable energy sources may hinder ongoing technical solutions for growing GDP (Bonaiuti, 2015; Kerschner, 2015; Sorman, 2015).

At the heart of these considerations lies the tension between the technical capability achieved by mankind and the political nature of the choices this power demands. While optimistic attitudes to technological progress still prevail, other attitudes have emerged, of ambivalence and scepticism, which may encourage both the politicization of technology and an axiological evaluation of technology. The environmental movement, for example, played a role in questioning the direction of technology, monitoring reactions to the Chernobyl disaster, climate change and increasing inequality in the world (Guha, 1989; Kothari, 1990; Beck, 1995 [1991]; Grunwald, 2018).

Rather than searching for the root of problems or for multiple solutions, the dominant tendency in the modern world has been to see technology as the solution to all problems. Weinberg (1966) designated this tendency as the *technological fix*. More recently, Morozov (2013) named it *technological solutionism*, and Kerschner and Ehlers (2016) called it *cornucopianism* or, more generally, *technological enthusiasm*. Winner (1986) coined the term *technological somnambulism* to depict a culture firmly bent on *making* and *using* sophisticated instruments, techniques and systems to improve the human condition but only reluctantly addressing its own foundations. All these terms question attitudes of using one or several technologies to solve socially complex problems as being more effective than seeking to change dominant policies and social outlooks.[2] It also ignores the fact that each technological solution creates new problems, which Rescher (1999: 119) called the "Hydra effect".[3]

Enthusiasm, however, is only one of the attitudes visible today in relation to science and technology. According to Kerschner and Ehlers' study quoted above, *determinism*, *romanticism* and *scepticism* are other categories to be taken into account.[4] It is based on an analysis of ecological economics lecture material, with strong reference to technology and innovation, and on responses to questionnaires applied to instructors. Currently, optimism is the dominant note, but the tendency is towards a diversity of attitudes. The fact that there are attitudes of ambivalence and suspicion indicates that they might be the foundation for a new type of creativity and innovation.

This discussion invites re-politicization of the public debate on technological choices. As has been acknowledged, the route to a degrowth society must seriously consider the idea of limits to and restrictions on its activities (Schneider et al., 2010). Winner (1978: 80) already saw technology as a driving force in the social world.

[2] This logic is also found in the well-known IPAT identity put forward in the 1970s (e.g. Commoner, 1972; Ehrlich and Holdren, 1971), which describes environmental impact (I) as the product of population size (P), wealth *per capita* (A) and damage caused by technology (T). The IPAT model sees environmental problems as always involving multiple driving forces, and in turn that there are multiple ways of reducing the impact of those forces. Despite this multiplicity, the key factor is technological progress, because there has been no decline in consumption, and population size is a controversial subject amongst emerging and developing countries (in the degrowth literature, see Kerschner, 2010).

[3] The *Hydra Effect* is an expression which refers to the myth of the many-headed monster, in which each decapitated head is replaced by two new ones. With this image, Rescher seeks to express the idea that the progress of science, technology and human artefacts generates dynamic feedback interaction between problems and solutions which, in the final analysis, means that each successive solution generates new problems (1999: 119–121). The picture of the Hydra as the many-headed monster ties in well with Ellul's (1964) analysis of technique. Ellul argues that technique inevitably produces unintended consequences, so-called secondary effects, which in turn are answered by new technique. In this way an endless cycle of new technique is produced, justified by problems caused by previous technique producing new problems. On the importance of the unintended side effects, within degrowth, see, for example, Grunwald, 2018.

[4] For a more detailed analysis of each of these attitudes, see Kerschner and Ehlers (2016).

Such is its power in influencing the "forms of life"[5] – understood as patterns of social relationships, consciousness and behavior, adapted to technology – that other ways of thinking about the human condition are rendered impotent or even obsolete. This dominance is accepted as a fundamental truth, because it enshrines the prevailing ideal of "progress" in social thought during the industrial age. Currently, and contrary to degrowth stances (Kallis, 2011; Wells, 2018), such a position assumes the belief that market forces will do the job if only any hurdles be kept out of the way of general technological development (Winner, 1986: 10). The underlying logic is that technological innovation should be celebrated for itself alone, and adopted quickly and without hesitation, regardless of any discussion on the practical implications and benefits of any given technology on collective life (Garcia, 2012, 2014). The link between technical development and the good life is thus always taken for granted. But this insistent framing of the human condition leads to a renunciation of the very capacity of people and communities to choose how to live their lives and take part in their most important decisions. New narratives for innovation are needed, fed by more democratic and sustainable imaginaries (Strand et al., 2018).

Methodological Luddism, as will be detailed in the following sections, is a manifold approach to establishing political scrutiny of technology. Its adoption could narrow the wide gap between means and ends opened up by contemporary technology. Winner hypothesizes that when groups or individuals choose to disconnect from certain technological systems, this creates a space where "withdrawal" experiences emerge. This space makes it possible to evaluate the structure of needs, habits and relationships with things and other individuals in a technologically mediated existence (Winner, 1978: 332). In the context of the degrowth project, this may mean decoupling technologies from the mere search for economic wealth and a basic reassessment of the assumptions that guide or are connected with economic growth and the institutions associated with and depending on it. Overall, it aims at justifiably empowering political actors towards a technological self-determination based on the clear connection between forms of life and technological usage.[6] The theory that technology is value-neutral comes into question once it is realized that technology and values shape each other.

3. Responsibility-guided technological development

Winner argued for new ways of describing and explaining technological change that go beyond those that see it as mere applied science or as the heir to the mark of progress. The weakness of these assumptions is that they overlook how technologies are not merely *made* by engineers and *used* by consumers. All the devices present in our daily lives as "just" more technologies will eventually merge into a linked technological system interacting with humans, forming novel forms of social and moral life (Winner, 1986). Hence they condition the landscape of social and environmental values and how they are pursued and maintained.

Hans Jonas' (1979) thought stresses Winner's focus on the need to define the proper ends of technology. Jonas' take on the technological era is demanding, in that it requires a rethinking of the proper tasks of ethics and a new rationale for action. The power of contemporary technology has been continuously extending over the physical world and human life to the point that its usage has unavoidable ethical implications. Current technological progress has engendered a dissociation between means and ends. Technology has largely become its own end through the search for ever greater power and fundamentally new performative scope over nature and humankind. According to Jonas, most ethical systems of the past, namely utilitarianism and deontology, are unable to accommodate the role of responsibility in the new circumstances. Those ethical systems assumed the human good to be immediately or locally determinable; responsibility, as a function of power and knowledge, was hence well grounded and limited, as the scope of action was either knowable or predictable (Jonas, 1973).

Technological power has rendered human action so ambiguous, permanent and cumulative that it demands a re-evaluation of ethical judgments and a shift in human responsibility for nature, since it is now dangerously subject to growing exploitation. The balance between the scope of human action and predictive skills has been undermined. Predictive knowledge of the consequences of technology is full of uncertainty and is therefore beyond our actions which are technologically guided. In sum, a locally confined ethics needs to be replaced by an ethics that is concerned with the new spatial and temporal span of our actions (Jonas, 1973). The new assumptions are ignorance as the only certainty, and the duty of knowing coupled with an ever extant insufficiency of that same knowledge.

Means need to be appropriate to ends. This gap can be narrowed in two non-exclusive approaches: either by recovering and upgrading responsibility and politics or by gradually altering and assessing technology patterns until their range and ambiguity are restricted to workable and knowledgeable limits. Jonas' recommendations on the adoption of a precautionary attitude may be enacted by actively forestalling the unexpected effects of some technologies; this may well encourage local, confined but flexible technological solutions (Jonas, 1979). Either approach would restore and expand the ability to decide on and select certain technological projects and not others, as is already the case with several other rulings on social and environmental issues. This will purportedly halt the pointless adoption of any means based on its presumed utility. Winner nonetheless alludes to the insurmountable ignorance surrounding the ways of building a kind of technology which differs from the dominant pattern and is at the same time appropriate to a different kind of life (Winner, 1978: 328).

Collectively and democratically identifying the ends towards which technology should be moving can prove troubling. Technological systems, networks and artifacts are already installed in the "available physical and social space and employing the available resources" (Winner, 1978: 329). Currently, the degrowth project is fairly well furnished with an axiological discourse on desirable ends in relation to both environmental and social values (D'Alisa, Demaria, and Kallis, 2015). In this light, degrowth is a political project of dispossession in the strongest sense of the term, in which a review of current forms of life is aligned with the idea of the common good and its relationship with nature. Once the ends are settled, technological policies, projects and evaluations may follow. Meanwhile, methodological Luddism encourages the search for alternative configurations of social and technological affluence, needs and relations.

The various potential moral-technological landscapes, and how they currently differ from our own, should be topics for both comparative empirical studies and for research on how forms of life

[5] The "forms of life" concept goes back to Wittgenstein's term *Lebensform* in his *Philosophical Investigations*. Winner reconstructs the concept by linking Wittgenstein's notion of the existence of patterns of life which are tied to meaning-generating mechanisms with Marx's idea that social activity is an ongoing process of world-making (Winner, 1986).

[6] Within the groups and movements that consciously recover the Luddite legacy, it is worth mentioning, for example, the ecologists of *Earth First,* whose t-shirts carry the logo *Ned Ludd lives!;* the self-titled *California Croppers,* who write condemnatory letters to biotechnology companies; and in Spain the group *Los Amigos de Ludd* [the Friends of Ludd] which publishes a bulletin critical of industry.

conform to the ends of a so-called degrowth society. Alternative social-technological configurations demonstrate how technology may serve real ends and be used in a responsible way, and these features may be observed in the absence, rejection or scarcity of a specific technology or technological systems usually taken for granted and whose commodities are regarded as fundamental. They may simply assign those under their influence a greater and fairer amount of control over their design, operation and output (Winner, 1978).

4. Towards policies for the assessment and regulation of technology

Methodological Luddism thus seeks not only to correct possible misconceptions of current technologies, it is also a method of inquiry. It adopts the "expressed aim of studying their interconnections and their relationships to human need" (Winner, 1978: 330). Just like when a television set is deliberately turned off it opens a void and other ways of creatively filling up one's free time, by observing how individuals and institutions strip down from technological systems, relevant comments can be made, and opportunities for new technologies may arise. This opening would allow insight on what previous technological systems "are doing for or to mankind. If such knowledge were available, one could then employ it in the inventions of radically different configurations of technics, better suited to non-manipulated, consciously, and prudently articulated ends" (Winner, 1978: 330). Such an inquiry then searches for instances where technological systems could be partially disconnected or dismantled to learn and uncover how forms of life are affected with each downgrading technological shift.

This is a point at which technology, ethics and politics can meet again, as Jonas (1973) would recommend. The new approach for a technological age must then put justifiable responsibility-based restraints on technological development. Jonas' (1979) warning of the danger and excess of our technological powers is, in this view, a call for voluntary and political detachment, to slow down, to simplify the pace of our dependence on technology and let ends speak and create their own means. Humanity has always had an urge to be creative, and technological innovation is one of its most imposing achievements. This would not be the end of innovation as such, but rather imbuing it with a keen sense of goals, in line with general societal consensus on the importance of ends.

Because humanity has always valued knowledge and innovation, the regulatory practices to be implemented must always be discussed and weighed up in terms of ends. In the context of methodological Luddism, the assessment of technology thus involves reorienting technological innovation systems to criteria well beyond those of industrial or commercial utility which have hitherto been given priority. Existing regulatory experiences and bodies can be expanded to other fields, intensified in terms of assessment, and strengthened in terms of effective execution. Expansion means including the next industrial world which the recent technological surge is encouraging. Intensification means the need to include democratic, social and ecological values in technology assessment, based on recognition of risks and uncertainties, of the unexpected secondary and negative effects of some innovations, and of the impossibility of absolute control (Funtowicz and Ravetz, 1990; Wynne, 1992; Grunwald, 2018). Cost-benefit calculations and probabilistic risk analyses[7] cannot be accepted as unique in the spread of technology; it is necessary to establish a social contract based on the notion of social responsibility and on axiological pluralism (Jerónimo, 2014). Conclusions as to the appropriateness of certain technologies should, therefore, be the result of an assessment of the project's various dimensions (beyond the technical component) and of multiple visions, actors (producers and consumers), sensibilities, interests and values. These ideas are close to a more diversity-oriented, multi-dimensional assessment, as put forward in the stakeholder management (Freeman, 1984) and multi-dimensional approaches (Gómez-Sal et al., 2003; Gago and Rubalcaba, 2007), and to the concept of "post-normal science", in the sense that they seek to establish a space for citizen involvement, for the democratization of knowledge, and for incorporating a diversity of approaches, research methods and axiological commitments (Funtowicz and Ravetz, 1990; Ravetz, 1999).

According to Winner, existing methods of technology assessment reveal the ignored or underestimated effects of certain phenomena, and they often assume technological change as "cause" and whatever follows as "impact" (Winner, 1986). Those methods argue that "effects" or "impacts" will soon emerge, to be described and explained, and those who produce those effects and impacts ought to welcome those changes and adjust their way of life accordingly. But, as Winner notes, every technological novelty mandatorily assigns new roles and relationships between humans. Every new pattern of activity soon becomes a standard, producing a new understanding of values, judgements and human activities. Technology assessment should therefore recognize that most present-day technological change creates its own world and engineers social, environmental and political conditions and expectations. In Winner's opinion, to look at technological change that goes beyond either *making it* or *using it* turns the question into a matter of politics. Even though some technologies seem to have little or no significance, the move towards questioning technologies opens up a healthy space for breaking the spell of idle acceptance of how our everyday world is materially constituted. Recognizing this dimension encourages discussions on the implicit and explicit effects of technological innovation on society, based on empirical and axiological grounds that will render these choices more cogent (Winner, 1986).

It therefore seems reasonable to demand that the material circumstances that surround us be designed so as to promote values such as self-government, human freedom, creativity, sociability and care for the environment. Illich has noted the disciplined and creative playfulness that comes from establishing limits to unimpeded technological progress as *conviviality*; halting and evaluating it is a venture bent on preventing new kinds of serfdom (Illich, 1973). Only then will human choice escape the pressure of necessity and straightforwardly submit technological innovations to the wider guidance of self-determined goals, values and social contexts. Assigning scales and limits to technology allows a proper relation between society and its tools to be established.

Thus, another far-sighted adoption of methodological Luddism concerns that part of our society that requires experts to maintain, regulate and improve the current technological system. By refusing to continue to repair technological systems, institutions can simply stand aside and watch how people develop new, more rewarding and self-determined relationships with reality through technology (Illich, 1973: 11). As Winner writes: "Many of society's biggest investments at present are those that merely prop up failing technologies. (…) Perhaps a better alternative would be to let dying

[7] This analysis reduces the value of a thing to the price of a commodity traded in a market. This approach is very useful in judging whether a project or technology should go ahead, because it reduces its benefits and costs to a common measure. Although some things are easily bought or sold, there are others that are priceless, such as respect, dignity and the natural value of some ecosystems and living beings.

artifice die. One might then begin the serious search, not for something artificially 'better', but for totally new forms of sociotechnical existence" (1978: 333).

5. Practices for a reform of technology

Methodological Luddism looks both forwards and backwards. It mostly seeks to critically assess, regulate, disconnect, learn and restart. Technological withdrawal opens up opportunities to create new social configurations that allow technologies of a different scale and structure to surface through new habits, needs and an awareness of engagement and responsibility. Heikkurinen speaks of *releasement* in similar terms, as a much needed and different kind of mentality from the technological mind-set, one that can develop as "the (often unexpected) collapses of technological systems imply that refraining from the technological practice – either intentionally or by accident – is indeed necessary for a non-technologically dominated ethos and practice to emerge" (Heikkurinen, 2018: 8).

Disconnecting from technological systems through political means is a practical step towards achieving a more manageable balance, one which will help advance the degrowth society. Several thinkers (Schumacher, 1973; Illich, 1973; Schor, 2011), in addition to Winner, have already pointed out a set of features of technology as reinforcing the commons and community ties (Winner, 1978; Rommel et al., 2018). The withdrawal from energy- and expertise-intensive technological systems represents an opportunity to observe, renew and identify other favored social-technological configurations (Winner, 1978). These configurations would open up as old dependencies on devices became obvious. In the context of the degrowth movement, evaluating what technologies ought to be encouraged or curbed is paramount. In a context of limited global resources, namely oil, minerals and drinking water, other less energy-intensive technologies like solar panels, biofuels and wind turbines have been put forward as likely replacements (cf. Cattaneo and Gavaldà, 2010; Trainer, 2012; Kunze and Becker, 2015).

Electricity is a good example. In industrialized countries, connection to the conventional grid is essential for all homes, and freedom of choice is limited to choosing from a list of providers, but there are exceptions. Tatum (1994) investigated how the home power movement in the US, made up of 40,000 homeowners, succeeded in breaking down conventional access to electricity by installing its own home power systems using renewable energy sources. Being connected to conventional systems renders electricity easily available, but hides from users the way it is produced and distributed to their homes and what impact it has. On the other hand, home power systems are expensive and demand more maintenance.

The fact that home power users are off the grid of conventional power lines limits the availability of power and means they may be adversely affected by fluctuations, errors and operating costs. This intermittence demands commitment in the form of attention and maintenance, shaping users' lives and generating convivial interactions, ranging from negotiations on how and when to use certain appliances to tinkering with the design and optimization of a small-scale electrical network. As Rommel et al. state "these forms of decentralized and open technology enable people to fulfill their needs through their own creativity independent from the market" (Rommel et al., 2018). The home power movement illustrates ways in which changes can be made to forms of life in which the satisfaction of basic human needs has become institution-dependent. It was guided by a particular idea of ends, of what the good life is in relation to others, to work and to nature.

It is precisely in this context that Borgmann's (1984) proposal for a reform of technology through *focal things and practices* is located. They are not a way of rejecting or escaping from technology, but rather a way of reassessing its lead role through a commitment to other ends. As the Tatum example above shows, dedication to home power (focal practice) can replace mere electricity consumption from the conventional grid (a device), thus connecting creative human interaction with material reality and with the context in which commodities are produced. As in the Latin word "focus", meaning hearth, focal things gather one's life around other practices than ones taken up by devices. Borgmann defines focal things and practices as those ritual human activities that make life meaningful, "matters of ultimate concern that are other and greater than ourselves" (Borgmann, 1984: 169).

Unlike devices, *focal things and practices* do not require a division between means and ends and between work and leisure, as they produce feelings of gratification. Hence they contrast with the ease, availability and superficial connectedness of most contemporary devices. The orientation towards focal things and practices which center our lives seeks to bring final ends to concrete practices, acknowledging how those ends currently lie outside the more common assessments of technology.

To use Borgmann's terms (1984), one might think of the contrast between the automobile and urban bicycle use, which has been extensively documented and is at the heart of various cities' recent cycling policies (Pucher et al., 2010; Solnit, 2001). Both provide transportation, but the worlds and the skills they summon are completely different. The bicycle's mechanical simplicity,[8] the multiple interchangeability of its parts, and the fact that it requires physical effort to be driven mean that it can be appropriated and repaired by anyone in a creative manner. As Bradley notes, "the bicycle is a clear example of a convivial tool. It is fairly easy to understand, to repair, to tinker with, and to make fit the purpose chosen by the user. It can be modified to include child seats, cargo boxes, electric motors, different forms of brakes and gears, etc. While most bicycles are industrially mass-produced, they can be maintained and developed by everyday people, and users can even build new bikes from spare parts" (Bradley, 2018). The bicycle is hence an example of an empowering withdrawal that overturns the bondage of how "the habitual passenger cannot grasp the folly of traffic based overwhelmingly on transport. His inherited perceptions of space and time and of personal place have been industrially deformed" (Illich, 1974: 37).

But this could hardly be so if the technology in question were a device like a modern car. If it breaks down, most drivers are powerless: the way it provides transportation remains ever hidden in its *mechanism*. The car is a black box hiding the chain of labor relations associated with its logistics, assembly and resource extraction, as well as its environmental impact. According to Borgmann (1984), in the history of technology there is a pattern of mechanisms being increasingly concealed, as the commodity becomes ever more available and ubiquitous, while demanding no responsibility and commitment from the user.

The examples listed show how technologies which serve the same ends may produce different environmental and social relations, making some of them more relevant to the degrowth project. Surveys can outline what specific technological features are more compatible with the ends appropriate to degrowth. Implementing and importing a foreign technology, for example, is never a value-free venture. Faced with little or no financial capacity to acquire parts or goods, many communities often develop or

[8] It should be noted, however, that currently there are bicycles which incorporate high technology materials and systems. Even with older bicycles, some models may be quite complex.

adopt site-specific technological solutions to their problems, which therefore tend to be more flexible, repairable and empowering because they were born and embedded in a communal context. They tend to engender local responses through relationships with other human activities and with the environment (De Bozzi and Oroza, 2002; Smith, 2008).

6. Conclusion

This article offers a methodological concept with the view to building a world in which technological change is in harmony with the principles of responsibility and degrowth. The core of this concept revises the proposal for methodological Luddism as a practice or action *within* society which re-politicises the interactions between technological, economic and social options, and dissents from commercially oriented technology.

The relationship between humans and technology today should not henceforth be seen as being axiologically neutral, just as increased technological efficiency does not necessarily contribute to improving human life or to strengthening community ties. It is necessary to assess and outline the ethical, social and ecological effects of technologies, thereby reassessing and reorienting them so that informed decisions may be taken as to how they should be designed and developed as means to socially equitable and ecologically sustainable ends.

Behind this approach lies how technologies connect with forms of life and hence build worlds, an issue of major significance when new industries are arising such as those based on rapidly escalating commercial computerization and biotechnologies. While every technology contributes to social and environmental change, it is also true that the critical assessment, restructuring and contraction of technologies may also bring about creative social transformation. Technologies are also social constructs and interact with symbolic creativity and the cultural variations among social groups. There is, of course, potential technological flexibility which contrasts strongly with the current rigidity of larger-scale technological systems. It is not a question of doing away with technological innovation, but of stressing that there is a proper domain in which it is possible to promote or discourage technologies, providing concrete opportunities for scientists, engineers, designers, activists and communities to become involved. It is particularly important that social movements incorporate issues of technological policy as part of their struggles and demands, in order to remove them from expectations of short-term gain, power and wealth and place them in a timeframe measured by generations succeeding each other and by ecological conservation.

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References

Beck, U., 1992 [1986]. Risk Society: towards a New Modernity. Sage, London.
Beck, U., 1995 [1991]. Ecological Enlightenment: Essays on the Politics of the Risk Society. Humanities Press, New Jersey.
Bonaiuti, M., 2015. Bioeconomics. In: D'Alisa, G., Demaria, F., Kallis, G. (Eds.), Degrowth: a Vocabulary for a New Era. Routledge, New York, pp. 25–28.
Bourdeau, V., Jarrige, F., Vincent, J., 2006. Les Luddites: Bris des Machines, Économie Politique et Histoire, Ère, Maison-Alfort.
Borgmann, A., 1984. Technology and the Character of Contemporary Life. University of Chicago Press, Chicago.
Bradley, K., 2018. Bike kitchens: spaces for convivial tools. J. Clean. Prod. 197 (Part 2), 1676–1683. http://dx.doi.org/10.1016/j.jclepro.2016.09.208.
Cattaneo, C., Gavaldà, M., 2010. The experience of rurban squats in Collserola, Barcelona: what kind of degrowth? J. Clean. Prod. 18 (6), 581–589.
Chevassus-au-Louis, N., 2006. Les Briseurs de Machines: De Ned Ludd à José Bové. Seuil, Paris.
Commoner, B., 1972. The environmental cost of economic growth. In: Population, Resources and Environment. Government Printing Office, Washington, DC, pp. 339–363.
D'Alisa, G., Demaria, F., Kallis, G., 2015. In: Degrowth: a Vocabulary for a New Era. Routledge, New York.
D'Alisa, G., Kallis, G., 2015. Post-normal science. In: D'Alisa, G., Demaria, F., Kallis, G. (Eds.), Degrowth: a Vocabulary for a New Era. Routledge, New York, pp. 185–188.
De Bozzi, P., Oroza, E., 2002. Objets Réinventés: La Création Populaire à Cuba. Editions Alternatives, Paris.
Dupuy, J.-P., 2002. Pour Un Catastrophisme Éclairé: Quand L'Impossible Est Certain. Seuil, Paris.
Ehrlich, P.R., Holdren, J.P., 1971. Impact of population growth. Science 171, 1212–1217.
Ellul, J., 1964. The Technological Society. Knopf, New York.
Ellul, J., 1988. Le Bluff Technologique. Hachette, Paris.
Freeman, R.E., 1984. Strategic Management: a Stakeholder Approach. Pitman, Boston.
Funtowicz, S.O., Ravetz, J.R., 1990. Uncertainty and Quality in Science for Policy. Kluwer, Dordrecht.
Gago, D., Rubalcaba, L., 2007. Innovation and ICT in service firms: towards a multidimensional approach for impact assessment. J. Evol. Econ. 17, 25–44.
Garcia, J.L., 2012. El discurso de la innovación en tela de juicio: Tecnología, mercado y bienestar humano. Arbor 188 (754), 19–30.
Garcia, J.L., 2014. La 'crisis' y la metamorfosis del capitalismo. Rev. Española Sociol. 22, 145–161.
Gómez-Sal, A., Belmontes, J.-A., Nicolau, J.-M., 2003. Assessing landscape values: a proposal for a multidimensional conceptual model. Ecol. Model. 168, 319–341.
Guha, R., 1989. Radical American environmentalism and wilderness preservation: a Third World critique. Environ. Ethics 11, 71–83.
Grunwald, A., 2018. Diverging pathways to overcoming the environmental crisis: a critique of eco-modernism from a technology assessment perspective. J. Clean. Prod. 197 (Part 2), 1854–1862. http://dx.doi.org/10.1016/j.jclepro.2016.07.212.
Heikkurinen, P., 2018. Degrowth by means of technology? A treatise for an ethos of releasement. J. Clean. Prod. 197 (Part 2), 1654–1665. http://dx.doi.org/10.1016/j.jclepro.2016.07.070.
Ihde, D., 1993. Postphenomenology: Essays in the Postmodern Context. Northwestern University Press, Illinois.
Illich, I., 1973. Tools for Conviviality. Harper & Row, New York.
Illich, I., 1974. Energy and Equity. Marion Boyars Publisher. London.
Jerónimo, H.M., 2014. Riscophrenia and "animal spirits": clarifying the notions of risk and uncertainty in environmental problems. Sci. Stud. 12, 57–74.
Jonas, H., 1973. Technology and responsibility: reflections on the new tasks of ethics. Soc. Res. Int. Quart. 40 (1), 31–54.
Jonas, H., 1979. The Imperative of Responsibility: in Search of an Ethics for the Technological Age. Chicago University Press, Chicago.
Kallis, G., 2011. In defence of degrowth. Ecol. Econ. 70, 873–880.
Kerschner, C., 2010. Economic de-growth vs. steady-state economy. J. Clean. Prod. 18 (6), 544–551.
Kerschner, C., 2015. Peak-oil. In: D'Alisa, G., Demaria, F., Kallis, G. (Eds.), Degrowth: a Vocabulary for a New Era. Routledge, New York, pp. 129–132.
Kerschner, C., Ehlers, M.-H., 2016. A framework of attitudes towards technology in theory and practice. Ecol. Econ. 126, 139–151.
Kothari, R., 1990. Environment, technology, and ethics. In: Engel, J.R., Engel, J.G. (Eds.), Ethics of Environment and Development: Global Challenge, International Response. Belhaven Press, London, pp. 228–237.
Krimsky, S., 2004. Science in the Private Interest: Has the Lure of Profits Corrupted Biomedical Research? Rowman & Littlefield Publishers, Lanham, MD.
Kunze, C., Becker, S., 2015. Collective ownership in renewable energy and opportunities for sustainable degrowth. Sustain. Sci. 10, 425–437.
Latouche, S., 2007. Petite Traité de la Décroissance Sereine. Mille et Une Nuits, Paris.
Martins, H., 2011. Experimentum Humanum: Civilização Tecnológica e Condição Humana. Relógio d'Água, Lisboa.
Morozov, E., 2013. To Save Everything, Click Here: the Folly of Technological Solutionism. PublicAffairs, New York.
Nørgård, J.S., 2013. Happy degrowth through more amateur economy. J. Clean. Prod. 38, 61–70.
Nowotny, H., Pestre, D., Schmidt-Assmann, E., Schulze-Fielitz, H., Trute, H.-H., 2005. The Public Nature of Science under Assault: Politics, Markets, Science and the Law. Springer, Heidelberg.
Pucher, J., Dill, J., Handy, S., 2010. Infrastructure, programs, and policies to increase bicycling: an international review. Prev. Med. 50, S106–S125.
Ravetz, J.R., 1999. What is post-normal science. Futures 31, 647–653.
Rescher, N., 1999. Razón y Valores en la Era Científico-Tecnológica. Ediciones Paidós, Barcelona.
Rommel, J., Radtke, J., von Jorck, G., Mey, F., Yildiz, Ö., 2018. Community renewable energy at a crossroads: a think piece on degrowth, technology, and the

democratization of the German energy system. J. Clean. Prod. 197 (Part 2), 1746–1753. http://dx.doi.org/10.1016/j.jclepro.2016.11.114.
Sale, K., 2006. La Révolte Luddite: Briseurs de Machines à l'Ère de l'Industrialisation. Éditions L'Èchappée, Paris.
Schneider, F., Kallis, G., Martinez-Alier, J., 2010. Crisis or opportunity? Economic degrowth for social equity and ecological sustainability. Introduction to this special issue. J. Clean. Prod. 18, 511–518.
Schor, J., 2011. True Wealth: How and Why Millions of Americans Are Creating a Time-rich, Ecologically Light, Small-scale, High-satisfaction Economy. Penguin Books, New York.
Schumacher, E.F., 1973. Small Is Beautiful: a Study of Economics as if People Mattered. London, Vintage Books.
Smith, C., 2008. Design for the Other 90 Per Cent. The University of Chicago Press, Chicago.
Solnit, R., 2001. Wanderlust: a History of Walking. Verso, London.
Sorman, A., 2015. Societal metabolism. In: D'Alisa, G., Demaria, F., Kallis, G. (Eds.), Degrowth: a Vocabulary for a New Era. Routledge, New York, pp. 41–44.
Strand, R., Saltelli, A., Giampietro, M., Rommetveit, K., Funtowicz, S., 2018. New narratives for innovation. J. Clean. Prod. 197 (Part 2), 1849–1853. http://dx.doi.org/10.1016/j.jclepro.2016.10.194.
Tatum, J.S., 1994. Technology and values: getting beyond the 'device paradigm' impasse. Sci. Technol. Hum. Val. 19 (1), 70–87.
Thompson, E.P., 1963. The Making of the English Working Class. Penguin Books, Toronto.
Trainer, T., 2012. De-growth: do you realise what it means? Futures 44, 590–599.
Van Daal, J., 2012. La Colère de Ludd: La Lutte des Classes en Angleterre à l'Aube de la Révolution Industrielle, L'Insomnique, Montreuil.
Verbeek, P.-P., 2011. Moralizing Technology: Understanding and Designing the Morality of Things. The University of Chicago Press, Chicago and London.
Weinberg, A., 1966. Can technology replace social engineering? B. At. Sci. 12 (10), 4–8.
Wells, P., 2018. Degrowth and techno-business model innovation: the case of Riversimple. J. Clean. Prod. 197 (Part 2), 1704–1710. http://dx.doi.org/10.1016/j.jclepro.2016.06.186.
Winner, L., 1978. Autonomous Technology: Technics-out-of-control as a Theme in Political Thought. MIT Press, Cambridge, MA.
Winner, L., 1986. Technologies as forms of life. In: The Whale and the Reactor: a Search for Limits in an Age of High Technology. University of Chicago Press, Chicago, pp. 3–18.
Wynne, B., 1992. Uncertainty and environmental learning: reconceiving science and policy in the preventive paradigm. Glob. Environ. Change 2 (2), 111–127.